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A new Laniarius, *L. lagdeni*, from Ashantee, has been described by Mr. R. B. Sharpe.

Mammals.—An examination of the uterus of the four-horned antelope, made by W. F. R. Welden, showed that it is divided into two compartments by a partition extending one inch into a passage internal to the os uterus. The Fallopian tubes are very small. The placenta is exactly intermediate between the completely diffuse one of Moschus, and the complexly cotyledonary apparatus of the sheep, for example, on the other. Each fœtus has twenty-two to thirty cotyledons.

The lesser koodoo (*Strepsiceros imberbis*) differs from *S. kudu*, not only in its smaller size, but in the absence of the fringe of long hair down the neck in front, and in the much more compressed spiral of the curvature of the horns. Mr. Holmwood, British Consul at Zanzibar, states that it occurs on the Juba river, exactly under the equator, in groups of three or four. A stuffed example from Somali land is in the British Museum.

EMBRYOLOGY.[1]

ON THE AVAILABILITY OF EMBRYOLOGICAL CHARACTERS IN THE CLASSIFICATION OF THE CHORDATA.—The development of a median axial cord, differing essentially from cartilage, and which seems to arise from a strand of cells constricted off longitudinally from the upper side of the hypoblast and having the same or almost the same extension anteriorly and posteriorly as the nervous cord, at once distinguishes all embryo and primitive Chordata from all other types, and justifies the substitution of the latter term for the older name, Vertebrata. It is obvious that the term Chordata is a more applicable one for the reason that there are forms which never develop vertebræ, while there are none in this series which fail to develop a notochord at some stage, having the antero-posterior extension described above. The name Vertebrata, therefore, carries with it implications which are not justified by facts. Lankester insists for this reason that the term Vertebrata be abandoned, and that the word Chordata be substituted for the name of the phylum, so as to express a fundamental truth in scientific taxonomy.

It has been insisted that embryological data are not available for the purpose of discriminating classes, subclasses, etc., and, judging from the more or less unsatisfactory attempts made to arrange the Chordata on a purely embryological basis, this opinion has not been without foundation. The following notes are not so much intended to bring a new system to the notice of naturalists as to arrange some of the data of embryology in what seems to the writer a rational order. While it must be admitted that our knowledge is still imperfect in relation to the development of certain considerable groups, every addition to that knowledge demonstrates that what has appeared to be exceptional or in violation of general principles, upon further investigation has really substantiated those principles. Inasmuch as the theory of evolution, as well as that of embryology, first considers the simplest phases of differentiation, the order in which the types should be successively considered will be an ascending one, in which we will pass from the least to the most differentiated modifications of the egg and embryo, without admitting, however, that the order of arrangement here adopted is indicative of the exact course which the evolution of the groups has taken. That is a problem which for obvious reasons no one will probably ever solve or succeed in stating with more than partial accuracy. The scheme which follows is therefore offered merely to show the arrangement which results when embryological characters alone are used, and will, the writer believes, serve at least to bring together the principal facts so as to display the direction along which specialization has progressed in the course of the evolution of the modes of development of the various chordated forms.

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The Chordata present three well-marked modes of embryonic development consequent mainly upon the manner in which the germinal matter of the egg is related to the vitellus, and upon how much the latter takes part directly in the formation of the embryonic organs, and in what manner the blastula or blastophere is directly related to its environment in the course of its development and growth. The direct influence of conditions which induce modifications in a purely mechanical manner is very plainly illustrated in embryological development; in fact it may be shown that the highest type of development as displayed in the greatest complexity of the germ or embryo has grown out of a simpler condition developing under simpler environing conditions. It may thus be shown that *even the mode of development of the ovum has been modified through adaptation.*

I. The lowest and most unmodified expression of chordate development is that which I will call the Haplocyemate, as seen in the single type Branchiostoma. Here the embryonic axis develops directly from a double-walled gastrula formed by the invagination of one side of the blastula into the other half. The myotomes are developed from paired diverticula of the mesenteron, and the development is not modified in any way by the presence of a yolk-sack. This group embraces forms in which no part of the ectoblast is cast off when the embryo is set free, and in which there are no special respiratory saccular membranes developed in connection with any part of the blastula or blastodermic vesicle; no primitive streak.

Ovum with a zona radiata only, which becomes distended and tensely filled with water around the egg proper; no albuminous envelope and no outer shell or additional membranous covering. Cleavage total and equal, as a result of which a blastula is directly developed. The invaginated half of the blastula leads directly to the formation of the intestine. No actinotrichia or embryonic fin-rays developed. These features seem to distinguish the Leptocardii, or Haplocyemate forms from the succeeding ones.

II. The second great subdivision of the Chordata I will call the Epicyemate subphylum. In this series the embryo never becomes bodily invaginated or so pushed into the blastodermic vesicle as to become invested by up-growing folds of the ectoblast, but remains attached to the yolk by a stalk or is sessile upon and external to the latter, which may or may not form an integral part of the intestine. This group also embraces forms in which no part of the ectoblast is cast off when the embryo is set free. There is no amnion nor any functional allantois developed. The vessels of the yolk-sack, when developed, are respiratory in function. The primitive streak is either comparatively short or wanting. This subdivision answers very nearly to the Ichthyopsida of authors.

1. The lowest division of the Epicyemate series may be called the Ichthyoidea, and brings the Amphibia and Marsipobranchii together. In them the ovum is provided with a zona radiata; there is no outer albuminous envelope; the zona is often elastic, and the cavity it encloses may increase with the progress of development, and may be covered externally with an adhesive or gelatinous investment. The cleavage is unequal; no true blastodisk is formed; the germinal and nutritive poles are, however, soon defined at opposite poles of the egg. Vitellus segmented into large spheres which enter into the formation of the inferior portion of the intestinal wall. Oviparous, or the ova are carried about by the parent in dermal pouches.

a. The first subseries of the Ichthyoidea is enterotrophous, that is, the yolk-cells in the embryo are in a ventral position, and extend along the whole of the middle and posterior part of the developing intestine. Amphibia.

b. The second subseries of the Ichthyoidea are opisthotrophous, that is to say, the yolk-cells while they enter into the formation of the ventral portion of the intestinal wall as in *a*, they are in a posterior position; the embryonic axis is formed from behind forwards, so as to appear as if it grew out from the posteriorly-placed mass of yolk-cells. Petromyzon.

Much may be said in favor of affiliating the marsipobranchs with the amphibians, but whether the development of Myxine will countenance the foregoing arrangement remains to be learned. It is, however, very certain that the general plan of development of the two preceding series approximates that of Branchiostoma far more closely than the more specialized development of the Ichthyes.

2. The highest major group in the Epicyemate subphylum I will call Ichthyes, as it is the only series in which true fin-rays are developed, and in all of the forms embraced by the term true embryonic fin-rays, or actinotrichia, may be found in the fin-folds of the embryo.

The ovum is provided with a zona radiata, but is entirely without or has only an inconsiderable albuminous envelope, rarely with loose granules of proteinaceous matter included between the vitellus and zona; no chalazæ; no calcareous shell, though sometimes there may be present in addition an outer tough, fibrous envelope (Elasmobranchs), or a canaliculated gelatinous (Perca), or a partially separate adhesive investment (Amiurus). The cleavage is partial, but a well-defined blastodisk is developed: the blastophere is formed by epiboly or growth over the vitellus. The vitelline matter is contained in the inferior pole of the blastophere, but never enters directly into the formation of a part of the intestinal wall.

a. The first subordinate group under Ichthyes is characterized by being ectotrophous, for the reason that the embryo is sessile for only a short time, as it soon becomes folded off from the yolk and raised upon a hollow umbilical stalk, so that the yolk eventually occupies an apparently extra-abdominal position, or rather it lies in a bulbous extension of the abdominal cavity. This series embraces the Selachians and Holocephali.

b. The second subdivision of the Ichthyes is equivalent to the Teleostomi of authors. These, as far as known, are cœlotrophous, that is to say, the embryo is sessile upon the yolk, and is never folded off so as to develop a stalk; the yolk is intra-abdominal and below the intestine and between the latter and the greatly distended somatopleure.

The Teleostei, Holostei and Chondrostei belong here, and it will be very surprising if any embryological characters are ever found which will separate the archaic Crossopterygians and Dipnoans from this series. For the characters of the latter we must, however, await the results of the researches of Mr. Caldwell.

III. The third subphylum of the Chordata is Endocyemate, that is, the embryo is more or less completely invaginated into the blastodermic vesicle at an early stage, in consequence apparently of its being confined in a contracted space, such as the uterine cavity or outer egg-membranes and shell, as a result of which are formed from the ectoblast, during the further growth of the embryo: (1) the amnion and its cavity, (2) the false amnion and its cavity; into the resulting space between these two membranes the allantois and umbilical vesicle are extended. The primitive streak is usually more or less prolonged behind the embryonic axis. This subphylum embraces forms in which a part only of the ectoblast enters permanently into the formation of the embryo, while a larger portion from which the false amnion or the *Reichert'sche deckschicht*, Rauber, subzonal membrane, Turner, serous envelope, von Baer, and the true amnion, are formed, is cast off at birth or when incubation is completed. A highly vascular allantois is also developed in the majority of the species of this group, and, as a rule, takes the most important share in the respiratory functions of the embryo, and in the development of the fœtal part of the placenta whenever that organ is present.—*J. A. Ryder.* [*To be continued.*]

PHYSIOLOGY.[1]

PFLÜGER'S "AVALANCHE THEORY" OF NERVE-CONDUCTION.—M. Vulpian calls attention to the fact that in faradisation of various motor areas in the cerebral cortex of the dog, the effective strength of current which must be used varies definitely with the region stimulated. The minimal effective strength of current for the muscles of the face is less than that for the muscles of the fore-limb, and still less than for the muscles of the hind-limb. In general the strength of effective current must increase with the length of motor nerve tract. This result is readily explained if we consider that the nervous impulse started in the brain gradually diminishes in power as it passes along the motor nerve. But this assumption is in contradiction to the classic "avalanche theory" of Professor Pflüger, according to which the nerve impulse accumulates energy in its progress, so that a certain strength of stimulus applied to a motor nerve produces a stronger contraction the farther the place excited is removed from the muscle. It is this theory which Vulpian undertakes to test, and concludes with a denial of its adequacy.

In Vulpian's experiments dogs were used and so heavily chloralized as to paralyze the reflex powers of the spinal cord. He carefully isolated, without cutting, the external popliteal branch of the sciatic nerve and also the anterior tibial nerve. These nerves are in the dog of about the same thickness. Vulpian found that with a weak current strong flexion of the foot was brought about by stimulating the anterior crural, while no movement was produced when the popliteal branch was excited with the same current. He therefore concludes that the nervous impulse, far from gathering strength in its passage along a nerve, is used up in its progress and gradually diminishes in intensity.—*Comptes Rendus, Tome C, p. 1038.*

MOVEMENT OF THE RETINAL CONES UNDER THE INFLUENCE OF LIGHT.—But three kinds of physiological change have been observed in the retina as an effect of the action of light: 1. The electrical currents discovered by Holmgren; 2. The bleaching of the visual purple in the outer segments of the retinal rods; 3. The movement of the pigment in the outermost or epithelial

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[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.